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EARLY POST-OPERATIVE DYSFUNCTION OF A MECHANICAL AORTIC VALVE

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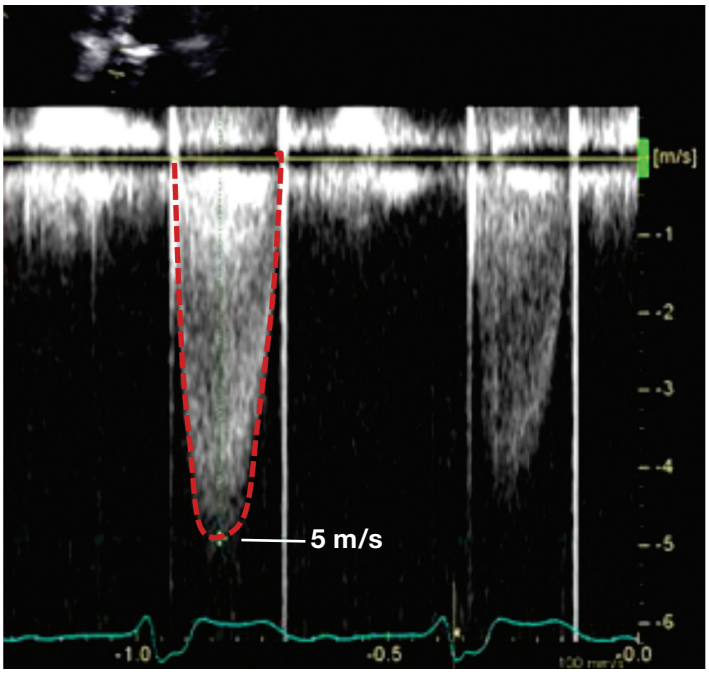

Figure 1. Transthoracic Doppler study demonstrates a high pressure gradient (100 mmHg) across the prosthetic aortic valve.

Case Report

A 49-year-old-male was referred to the Methodist DeBakey Heart & Vascular Center for evaluation of prosthetic valve endocarditis. His medical history was significant for aortic valve replacement in 2010, with a 23 mm mechanical aortic valve due to a bicuspid aortic valve with severe stenosis. Approximately 1 year later, he developed fatigue and mild dyspnea. Transesophageal echocardiography (TEE) demonstrated a large paravalvular defect with severe aortic regurgitation. Three different blood cultures were positive for Staphylococcus epidermidis. The affected mechanical valve was explanted, extensive debridement of the aortic annulus was performed, and a new 23 mm mechanical aortic valve was implanted. Intraoperative TEE revealed normal valve seating with normal leaflet mobility. The patient was extubated 4 hours after surgery and had a routine postoperative recovery. Oral and intravenous anticoagulation was initiated the day after surgery.

Four days later the patient underwent routine transthoracic echocardiogram, which demonstrated a markedly elevated transvalvular gradient across the newly implanted mechanical aortic valve (peak velocity of 5 m/s, mean gradient of 61 mmHg, peak gradient of 100 mmHg, Doppler velocity index of 0.23 [normal >0.25]) with normal left ventricular function (Figure 1). Cinefluroscopy of the valve was performed to evaluate valve opening. Fluroscopy showed equally reduced opening of both prosthetic leaflets (opening angle of 40-50 degrees with

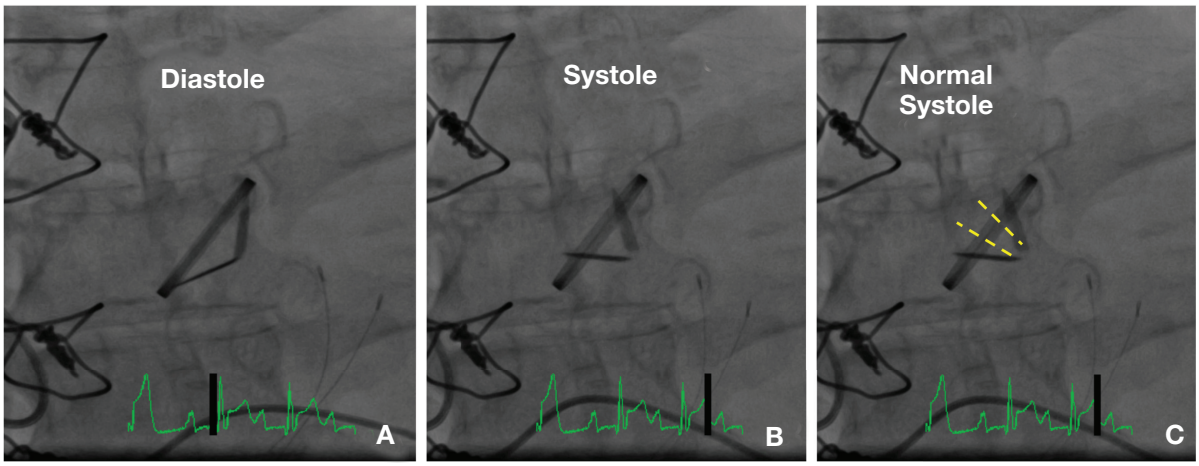

Figure 2. Cinefluroscopy demonstrates restricted leaflet function. (A) Normal diastolic leaflet closure is demonstrated. (B) During systole there is restricted mobility of both leaflets of the prosthetic mechanical aortic valve, with angulation between leaflets of 45-50 degrees. (C) A normally functioning bileaflet mechanical valve should demonstrate an opening angle of 10-12 degrees (yellow dotted lines).

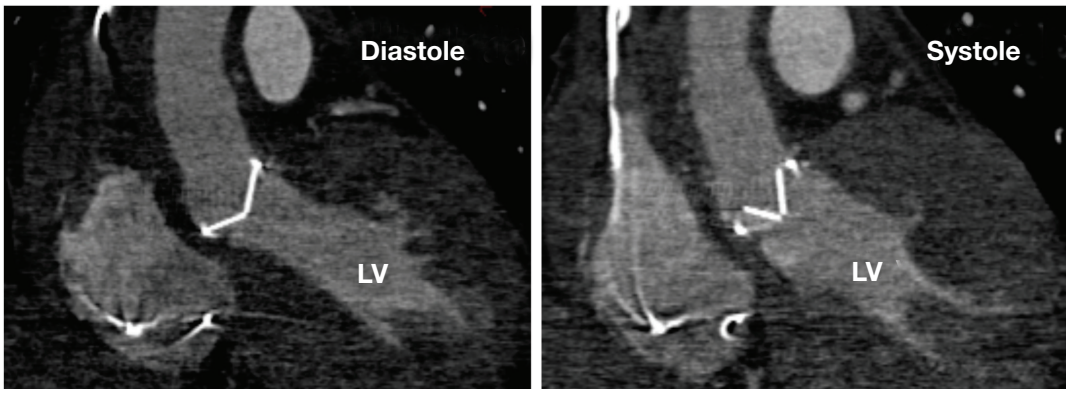

Figure 3. 64-slice gated cardiac CT demonstrates partial opening of the valve leaflets in systole without evidence of subvalvular clot or restrictive tissue.

normal closure) (Figure 2). For a normally functioning bileaflet mechanical valve, the angulation between the leaflets is 10-12 degrees when the valve is open and 120-130 degrees when the valve is closed.[1, 2] TEE was performed to assess for possible causes of acute valve obstruction, including thrombosis or vegetation; however, there was significant prosthetic valve shadowing, and a mechanism of prosthetic valve dysfunction could not be identified. A cardiac computed tomography (CT) was ordered to assess for thrombus — which would be seen as a low attenuation mass on the valve — or subvalvular tissue causing impaired leaflet motion. The CT clearly demonstrated reduced systolic leaflet motion without any evidence of subvalvular clot or restrictive tissue (Figure 3). After 1 week of anticoagulation within the therapeutic range, the transvalvular Doppler gradients remained elevated and unchanged.

Because of this acute prosthetic valve dysfunction, the patient once again underwent redo valve surgery. The mechanical valve was successfully explanted, and under direct inspection no apparent thrombus, suture, or tissue was identified on or around the valve. With manual manipulation, the explanted valve clearly demonstrated restricted leaflet opening (Figure 4). A new 21-mm bioprosthetic aortic valve was implanted, and postoperative echocardiogram demonstrated normal valve function and Doppler gradients. The patient was discharged home in stable condition.

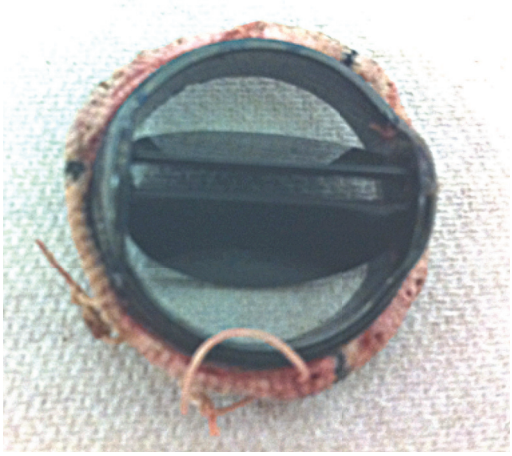

Figure 4. Photo of explanted valve showing restricted mobility of both leaflets.

Comment

We report a case of very early postoperative mechanical aortic valve obstruction. Restricted leaflet opening of prosthetic mechanical valves may be due to aberrant suture or pledget material, incomplete decalcification of the aortic annulus, thrombus (early or late), or pannus (late) formation. Any of these rare mechanisms of dysfunction tend to cause unilateral or asymmetric leaflet restriction in systole or diastole. In this case, multiple imaging modalities (echo Doppler, cinefluoroscopy, and CT) demonstrated acute systolic valve dysfunction involving both mechanical leaflets, however neither this noninvasive imaging nor direct inspection of the explanted valve could identify a macroscopic cause of the restricted leaflet motion. Possible explanations for acute mechanical valve dysfunction include mechanical valve failure (although the intraoperative TEE demonstrated normal prosthetic valve function) or possibly microthrombi at the pivot/hinges of the leaflets that could not be identified by routine imaging and visual examination. In this case, the explanted valve was returned to the valve manufacturer and thoroughly examined. That report indicated that "two of the recessed pivot areas contained thick coagulated blood," and that after cleaning the explanted valve leaflets demonstrated normal function. In summary, we report a rare case of very early mechanical aortic valve dysfunction. The mechanism of prosthetic leaflet restriction in this case remains uncertain; however, we believe that microthrombi located within the leaflet pivot points (hinges) was likely a contributing factor.

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